Statement of Work

Rework Flight Weight Aluminum Tank 7/27/11

General:

1. The contractor shall modify an existing 54.5" Spherical Flight Weight Tank made from 2219-T81 Aluminum by replacing the existing seal design with a new type.
2. The contractor will also modify an existing lid, or fabricate a new lid made from 6061-T6 aluminum. The lid will mate with the above mentioned tank and includes five (5) Bi-metallic Conflat style flanges.
3. The reworked tank and new lid will be used with liquid hydrogen (-423 F).
4. The modification and fabrication shall be generally per the **intent** of the ASME Boiler and Pressure Vessel Code latest edition, Section VIII, Division 1 or Division 2 except for sections pertaining to stress levels due to the nature of this thin wall flight weight tank. It is **not** necessary for the Tank or Lid to be ASME approved and stamped. It does need to be designed to be safe, and pass pressure proof testing and leak check testing.
5. NASA will supply the 54.5" aluminum tank, lid, lid bolting, and tank support fixture. The fixture will be used for storage and shipping only and is not meant to be a machining fixture.
6. Extreme care must be used when handling the tank to protect it from rough handling that could cause damage. The tank must not be dropped. All sealing surfaces must be adequately protected. The tank must also be adequately supported and protected during moving and shipping.

Tank Rework:

1. The contractor shall modify an existing 54.5" Spherical Flight Weight Tank made from 2219-T81 Aluminum. Modifications shall consist of the following:
    a. Measure the main flange for flatness and correct only if necessary prior to incorporation of the new seal design groove. If modifications are necessary, discussions will be required prior to start of rework to determine the extent of the repair.
    b. Replace the existing size 12.00" ConoSeal female sealing surface located at the main tank penetration with a groove sized to accept an Ameriseal™ 12.750" C-Ring, Internal Pressure Style seal.
    c. Remove the existing lower nozzle flange and replace with a Ø4.50" Bimetallic Conflat style flange. The lower Ø2.50" nozzle elbow may also remain or may be removed to facilitate the repair in this area. Discussions are required to weigh fabrication advantages and disadvantages prior to removing the elbow.
    d. Attached sketches CR-61273-1, CR-61273-2, CF-61274, CD-61277 and CD-61278 are provided for reference.
    e. The contractor is to prepare their own fabrication drawing as needed to complete modifications to the two sealing areas.
2. Main Flange Groove and Seal details are as follows:
    a. Groove Technical Data
    Outer Diameter: 12.783/12.792"
    Inner Diameter: 12.272" maximum
    Depth: .198/.202"

Max corner radius: .060”
Surface finish: 8 rms to 16 rms, circular lay

b. Seal Technical Data
Seal type: Ameriseal™ C-Ring, Internal Pressure Style
Manufactured by American Seal & Engineering, Orange, CT
Size: 12.750” OD x .250 Free Height x .025 Wall
Material: Inconel 718
Temper: Solution Annealed and Age Hardened
Plating: Tin .002/.003”
Required seating load: 400 lb/inch-circumference

3. Should the groove prove too difficult to incorporate into the tank flange, the groove could be moved the mating lid flange. Discussions are required to weigh fabrication advantages and disadvantages prior to moving the location of the seal groove.
4. The contractor will provide one or more elastomeric type o-rings to use as necessary.
5. NASA will provide a Tank Support Fixture which can be used for cold shocking, pressure proof testing and helium leak testing of the reworked tank and new lid. This fixture is currently being fabricated.
6. The maximum allowable working pressure is 50 psig, and with a 65 psig proof, based on a maximum temperature of 100 F and minimum of -423 F.
    a. At some point in the past, the tank was originally intended for a higher internal pressure. The tank was originally to be proof tested to 100 psig, but exhibited signs of permanent deformation at 75 psig. This will be seen as a localized “flat area” near the main tank flange in “Photo3”. Flatness of the main flange appears to be acceptable, but will be verified by the vendor. The main flange out of parallelism with an internal flange at the bottom of the tank. The exact cause of this out of parallelism is not known as it could have occurred when it deformed or been due to issues from the original manufacture of the tank. Original manufacturing and inspection test reports are available.
7. “Keenserts” located in the eighteen (18) tapped holes have had the thread locking feature removed by running a bottom tap into each threaded hole. This was done to “clean up” the holes and guard against possible galling.

Lid Rework or New Fabrication:

1. The contractor will either
    a. Modify an existing lid made from 6061-T6 aluminum by removing the ConoSeal groove and machining a mating surface for the Ameriseal

    - or -

    b. Fabricate a new lid if modification of the existing lid is not feasible or cost effective. The quote should include the price of a newly fabricated lid.
2. The existing lid with 12.00” ConoSeal male sealing surface is shown on sketch G44710MRA031. The reworked or new lid will be identical except for the incorporation of the new seal design. The existing ConoSeal type seal is shown on “Detail B, ConoSeal Groove Detail”. ConoSeal details are also provided on the attached Aeroquip drawings noted in the attachments.
3. Should the groove prove too difficult to incorporate into the tank flange, the groove could be moved the mating lid flange. Discussions are required to weigh fabrication advantages and disadvantages prior to moving the location of the seal groove.

4. The sealing area will require a surface finish similar to that specified for the groove.
5. Thermal expansion differences between the dissimilar aluminums have been investigated are not considered to be negligible.
6. For shipping, the Tank, Lid and Pressure Test Fixture shall be properly assembled, supported and restrained to prevent damage.

Testing, Inspection, Documentation:

1. All new welds must be cold shocked with liquid nitrogen (LN2) to about -320F. The entire tank does not need to be filled with LN2. The tank and lid may be cold shocked separately. All welds shall be visually inspected to verify freedom from cracks.
2. All testing and inspection (visual and NDE) will be per ASME B&PV Sect VIII, Div I or Div II except for the proof pressure level 65 psig as previously noted.
3. Sealing surfaces need to be protected from damage during all operations including during cleaning and inspection.
4. After cold-shock testing, the Tank and Lid will be assembled and pressure proof tested to 65 psig.
5. After pressure proof testing, the reworked Tank and Lid assembly shall be helium gas leak tested per ASTM E-499. The maximum allowable leak rate is 1×10^{-7} standard cubic centimeters per second.
6. The contractor shall provide the following with the hardware delivery as applicable:
    a. Fabrication drawings.
    b. Manufacture's data reports.
    c. Design calculations and specifications.
    d. Mill test reports & impact testing results.
    e. Welding Personnel Qualifications (WPQ), Procedure Qualification Record (PQR) and Welding Procedure Specification (WPS).
    f. Inspection and NDE reports.
    g. Proof test reports.
    h. Leak check reports.

Attachments:

Tank Drawings:
CR-61273-1
CR-61273-2
CF-61274
CD-61277
CD-61278

Lid Drawing:
G44710MRA031

ConoSeal Specifications:
Aeroquip 50887
Aeroquip 50888
Aeroquip 50889

Photos:
"Tank1" - Overview
"Tank2" – Bottom nozzle
"Tank3" – Deformation
"Lid1